We claim:

1. An vehicle data system for processing and displaying vehicle data transmitted through a bus connector of a data bus on an electronically controlled engine operating in accordance with a predetermined bus protocol, comprising

a. a handheld computer including a memory for storing operating system software adapted to operate said handheld computer in accordance with a data protocol which is different from the vehicle bus protocol, a handheld microprocessor for executing the operating system software and an external data port which is physically incompatible with the bus connector of the data bus and which is connected to said handheld microprocessor to allow the vehicle data when properly formatted to pass into said handheld computer; and

b. an adapter for creating a data pathway between the bus connector and said external data port including

i. a data port connector for connection with said external data port of said handheld computer,

ii. a bus compatible connector for connection with the bus connector,

iii. a battery power supply separate from the power supply for said handheld computer and for the data bus, and

iv. an adapter microprocessor supplied with power from said battery power supply and connected via the data pathway with said bus compatible connector for protocol conversion of the data received from the vehicle bus for processing by said handheld computer and supplied to said handheld computer through said data port connector.

2. The vehicle data system as defined in claim 1, wherein said adapter further includes

a. a flexible cable having said bus compatible connector at one end and a cable connector at the other end, and

b. an adapter housing capable of being affixed to said handheld computer when said data port connector is connected to said external data port, said adapter housing including a cable compatible connector for engagement with said cable connector to complete the data pathway between the data bus and said adapter microprocessor.

3. The vehicle data system as defined in claim 1, wherein the data bus transfers data messages containing information regarding the engine and wherein said adapter microprocessor operates to convert the vehicle data between the bus protocol and the data protocol of said handheld computer.

4. The vehicle data system as defined in claim 3, wherein said adapter microprocessor determines the start and stop of messages received from the data bus and said adapter microprocessor further operates to add

message identifiers to the vehicle data conveyed to said handheld computer through said external data port.

5. The vehicle data system as defined in claim 4, wherein said handheld computer includes application software for permitting detection of said message identifiers added to the vehicle data by said adapter microprocessor.

6. The vehicle data system as defined in claim 5, wherein the signal levels of the vehicle data appropriate for transmission by the vehicle bus and for processing by said handheld computer are respectively different and wherein said adapter includes level adjustment means for converting the signal levels of the vehicle data to the appropriate levels as the vehicle data passes between the vehicle bus and said handheld computer.

7. The vehicle data system as defined in claim 6, wherein the vehicle bus operates in accordance with a J1587 protocol.

8. The vehicle data system as defined in claim 6, wherein the vehicle bus operates in accordance with a J1939 protocol.

9. The vehicle data system as defined in claim 6, wherein the data protocol of said handheld computer is an RS232 data link.

10. The vehicle data system as defined in claim 7, wherein the vehicle bus employs a J1708 data link.

11. The vehicle data system as defined in claim 4, wherein the message identifier includes a delimiting header block having a synchronization sequence and a message length.

12. The vehicle data system as defined in claim 5, wherein the application software within said handheld computer operates to synchronize with the messages received from said adapter employing the header block added by said adapter.

13. An vehicle data adapter system for creating a data pathway between a bus connector of a data bus on an electronically controlled engine operating in accordance with a predetermined bus protocol to convey data messages and a handheld computer which operates in accordance with a data protocol which is different from the vehicle bus protocol wherein the handheld computer includes an external data port which is physically incompatible with the bus connector of the data bus, comprising

a. an adapter housing external to the handheld computer,

b. an adapter microprocessor included in the data pathway between the data bus and the handheld computer, said adapter microprocessor being mounted within said adapter housing,

c. adapter memory for storing adaptor software for implementation by said microprocessor to perform the functions of the adapter system including protocol conversion of vehicle data transferred between the data bus and the handheld computer,

d. a data port connector for connecting the data pathway with the external data port of the handheld computer to allow vehicle data to be transferred to and from the handheld computer, and

e. a bus compatible connector for connecting the data pathway with the bus included in the data pathway for connection with the bus connector of the vehicle bus to allow vehicle data to be transferred to and from the vehicle bus,

wherein said adapter microprocessor operates to convert the vehicle data between the bus protocol and the data protocol of said handheld computer by determining the start and stop of messages received from the data bus and said adapter microprocessor further operates to add message identifiers to the vehicle data conveyed to the handheld computer through said external data port,

whereby the amount of processing that the handheld computer is required to undertake for data monitoring and extraction from the data bus is minimized.

14. The vehicle data adapter system as defined in claim 13, wherein the message identifier includes a delimiting header block having a synchronization sequence and a message length.

15. The vehicle data adapter system as defined in claim 14, wherein the message identifier includes a three-byte sequence: [112][254][len][J1587Message] where J1587Message is a standard J1587 formatted message.

16. The vehicle data adapter system as defined in claim 14, further including application software implemented by the handheld computer for

permitting detection of said message identifiers added to the vehicle data by said adapter microprocessor.

17. The vehicle data adapter system as defined in claim 13, further including a flexible cable forming a portion of the data pathway, said flexible cable having said bus compatible connector at one end and a cable connector at the other end, and wherein said adapter housing is capable of being affixed to the handheld computer when said data port connector is connected to the external data port of the handheld computer, said adapter housing including a cable compatible connector for engagement with said cable connector to complete the data pathway between the data bus and said adapter microprocessor.

18. The vehicle data adapter system as defined in claim 13, wherein the signal levels of the vehicle data appropriate for transmission by the vehicle bus and for processing by said handheld computer are respectively different and wherein the adapter system further includes level adjustment means for converting the signal levels of the vehicle data to the appropriate levels as the vehicle data passes over the data pathway between the vehicle bus and the handheld computer.

19. The vehicle data adapter system as defined in claim 13, wherein said adapter software allows engine operating conditions to be monitored.

20. The vehicle data adapter system as defined in claim 19, wherein said adapter software allows one or more of the following engine operating conditions to be monitored: throttle position, engine load, torque, oil pressure, boost pressure, intake manifold temperature, coolant temperature, coolant level, fuel rate, and engine speed.

21. The vehicle data adapter system as defined in claim 13, wherein said adapter software allows said adapter system to receive messages from the handheld computer including a message identifier having a three-byte sequence as follows: [120][254][len][J1587 Message], where J1587 message is a standard J1587 formatted message.

22. The vehicle data adapter system as defined in claim 21, wherein said adapter software allows said adapter system to buffer messages.

23. The vehicle data adapter system as defined in claim 14, wherein said adapter software causes messages received from the handheld computer to be unpacked and scheduled for transmission to the vehicle bus whenever a complete message is present and the bus has been inactive for the required amount of time based on the priority of the message.

24. The vehicle data adapter system as defined in claim 21, wherein said adapter software causes the default priority of all adapter transmitted J1587 messages to be 8 unless three consecutive collisions occur whereupon said adapter software shall reschedule the colliding message by randomly selecting a different message priority.

25. The vehicle data adapter system as defined in claim 13, wherein said adapter housing includes a battery supply connected to provide a power supply that is separate from the power supplies for the vehicle bus and the handheld computer and wherein said adapter software monitors the battery voltage at least once every 60 seconds.

26. The vehicle data adapter system as defined in claim 13, wherein the messages are arranged in a queue and said adapter software monitors each message queue and maintains the maximum depth each queue has reached.

27. The vehicle data adapter system as defined in claim 13, wherein said adapter software detects spurious interrupts should they occur.

28. The vehicle data adapter system as defined in claim 13, wherein said adapter software maintains an indication of the available throughput of said adapter microprocessor.

29. The vehicle data adapter system as defined in claim 13, wherein said adapter software transmits a status message at predetermined intervals, said status message contains at least one or more of the following firmware major and minor version, battery voltage, message queue depths, spurious interrupt indication, and the latest throughput value.

30. The vehicle data adapter system as defined in claim 13, further including data link software for monitoring selected information.

31. The vehicle data adapter system as defined in claim 30, wherein the vehicle bus operates on the J1587 data link protocol, said data link software further includes J1587 fault detection and monitors messages on the J1587 datalink.

32. The vehicle data adapter system as defined in claim 30, wherein said data link software supports one or more device MID's supported by the adapter system, wherein said data link software buffers the related fault

information for any PID 194 message received from a supported device so that the fault information is accessible to the handheld computer.

33. The vehicle data adapter system as defined in claim 30, wherein said data link software tracks updates as each PID 194 message is broadcast by a supported device and reset when the data link is disconnected from the transmitting device.

34. The vehicle data adapter system as defined in claim 33, wherein said data link software buffers one or more of the following information related to J1587 faults for any device on the data link with a supported MID: PID/SID, FMI, count, active/inactive status.

35. The vehicle data adapter system as defined in claim 34, wherein said data link software records the status of each buffered fault signal, said data link software records changes in the status of each buffered fault signal from active to inactive when no refresh fault signal has been received after a first predetermined time.

36. The vehicle data adapter system as defined in claim 34, wherein said data link software issues a request to trigger an update of all active and inactive faults, said data link software deletes any buffered inactive fault signal if that inactive fault signal has not been refreshed for a second predetermined time longer than said first predetermined time.

37. The vehicle data adapter system as defined in claim 34, wherein said data link software deletes all fault signals should the data link become inactive.

38. The vehicle data adapter system as defined in claim 36, wherein said data link software makes all buffered fault signals and their status available to the handheld computer.

39. The vehicle data adapter system as defined in claim 30, wherein said data link software monitors selected information regarding engine operating conditions and vehicle information relating to the vehicle on which the engine is mounted, said data link software monitors one or more of the following: throttle position, engine load, torque, oil pressure, boost pressure, intake manifold temperature, coolant temperature, coolant level, fuel rate, engine speed, maximum road speed, cruise control set speed, total idle hours, total idle fuel used, total vehicle distance, total vehicle hours, total engine hours, total PTO hours, total fuel used, vehicle identification number, component identification parameter, and software identification.

40. The vehicle data adapter system as defined in claim 30, wherein said data link software monitors parameters that are not broadcast by periodically sending a PID 0 request to obtain them.

41. The vehicle data adapter system as defined in claim 30, further including a battery power source mounted within said adapter housing, said battery source supplying all of the power requirements for said adapter microprocessor and adapter memory independent of the data bus and the handheld computer and wherein said data link software monitors the level of said battery power source, the data link traffic/adapter throughput and an indication of adapter communication error.

42. The vehicle data adapter system as defined in claim 30, wherein said data link software operates to obtain and buffer from the data bus the following static information regarding the engine: engine serial number, software identification, and unit number, said data link software operating to supply said static information for display by the handheld computer.

43. The vehicle data adapter system as defined in claim 13, further includes application software for causing the handheld computer to function to provide one or more of the following functions: display engine operating conditions, display related vehicle information, display fault information and to allow for change of data and for managing the data storage structure.

44. The vehicle data adapter system as defined in claim 43, wherein said application software causes the handheld computer to display one or more of the following engine parameters along with a description of the parameter, value and unit of each parameter: throttle position, engine load, torque, oil pressure, boost pressure, intake manifold temperature, coolant temperature, coolant level, fuel rate, engine speed, and to display one or more of the following vehicle parameters along with a description of the parameter, value and unit of each parameter: maximum road speed, cruise control set speed, total idle hours, total idle fuel used, total vehicle distance, total vehicle hours, total engine hours, total PTO hours, total fuel used, and to display one or more of the following name plate parameters: vehicle identification number, component identification parameter, and software identification.

45. The vehicle data adapter system as defined in claim 44, wherein said application software causes the handheld computer to refresh the

displayed engine parameters at regular intervals unless the engine parameter is updated at less frequent intervals whereupon the displayed engine parameters are refreshed when each engine parameter is updated.

46. The vehicle data adapter system as defined in claim 44, wherein said application software causes "No Data" to be displayed in the value field when no engine parameter data is received.

47. The vehicle data adapter system as defined in claim 46, wherein said application software causes the displayed engine parameter data to be inverted should the displayed engine parameter data not be refreshed within a predetermined time.

48. The vehicle data adapter system as defined in claim 47, wherein said application software causes "No Data" to be displayed for all engine operating parameters when the data link is disconnected or no data is received for any parameter.

49. The vehicle data adapter system as defined in claim 43, wherein said application software causes the handheld computer to display the status of the data link as "connected", "slow" or "disconnected".

50. The vehicle data adapter system as defined in claim 43, wherein said application software enables forms to be displayed including a trip form and enables the user of the handheld computer to initiate requests for trip parameters and enables automatic requests for trip parameters when the user requests a trip form and when the data link becomes active after a predetermined period of inactivity.

51. The vehicle data adapter system as defined in claim 50, wherein said application software causes the handheld computer to display "Not Supported" should trip parameters not be received within a predetermined time after user request.

52. The vehicle data adapter system as defined in claim 51, wherein said application software enables the user to enter trip information for storage and display and enables display of the approximate amount of available unused memory and average record size.

53. The vehicle data adapter system as defined in claim 43, wherein said application software enables display of fault signals using engine manufacturer fault codes, if available, and the corresponding MID, PID or SID, and FMI combination.

54. The vehicle data adapter system as defined in claim 53, wherein said application software enables display of information instructing the user regarding how to handle a particular displayed fault.

55. The vehicle data adapter system as defined in claim 54, wherein said application software enables storage and display of the serial number received from a Component Identification PID and the date of the upload used to identify the fault data records.

56. The vehicle data adapter system as defined in claim 43, wherein said application software causes the handheld computer to display manual entry forms to track supplemental information or support equipment that is without an electronic data link.

57. The vehicle data adapter system as defined in claim 43, wherein said application software causes the handheld computer to display manual entry overrides to correct data that are incorrect.

58. The vehicle data adapter system as defined in claim 13 further including application software for managing the data storage function of the handheld computer to allow all data collected and the textual description of faults, parameters, units and status for display and upload to a personal computer including one or more of the following functions:

a. storing trip information as a record identified by serial number, unit ID, and upload time.,

b. storing fault information as a record identified by serial number, unit ID, and upload time,

c. storing data plate information as a record identified by serial number, unit ID, and upload time,

d. storing manual forms information as a record identified by serial number, unit ID, and entry time,

e. making data stored on the handheld computer available for upload to a personal computer,

f. making data stored on the handheld computer available for review using the handheld computer,

g. allowing the user to delete data a single record at a time, and

h. storing textual description of PIDs, faults, and units.

59. The vehicle data adapter system as defined in claim 13, further including conduit software for transferring data to and from the handheld computer and a personal computer.

60. The vehicle data adapter system as defined in claim 59, wherein the conduit software is a Windows DLL™ that is called by a Palm™ HotSync™ manager during the handheld computer synchronization events whereby said conduit software transfers data acquired from the handheld computer to the personal computer where it can then be further analyzed.

61. The vehicle data adapter system as defined in claim 60, wherein said conduit software includes one or more of the following features:

a. a mechanism which allows for the installation of said conduit software on a personal computer,

b. a mechanism which supports the un-installation of the conduit software from a person computer,

c. a mechanism that date/time stamps all records stored on the personal computer,

d. a mechanism that writes data plate information to a comma-separated file which is not stored under a given users' specific directory,

e. a mechanism that writes engine vehicle data to a comma-separated file which is not stored under a given users' specific directory,

f. a mechanism that writes engine fault data to a comma-separated file which is not stored under a given users' specific directory,

g. a mechanism for appending trip or fault incoming data to the respective output file if it already exists without overwriting existing data, and

h. a mechanism for creating a file when an output file does not exist.

62. A method for creating a data pathway between (1) a data bus on an electronically controlled engine having a first electrical power source which data bus operates in accordance with a predetermined bus protocol to convey multi-byte data messages of varying length and (2) a handheld computer having a second electrical power source separate from the first which operates in accordance with a data protocol which buffers received bytes of data for access by application software without keeping track of when the bytes are received thereby losing indications of the start and stop of multi-byte data messages, comprising

a. interconnecting the data bus and the handheld computer to form the data pathway external to both the data bus and the handheld computer to allow multi-byte data messages of varying length to pass between the handheld computer and the data bus,

b. intercepting the messages conveyed on the data pathway from the data bus to the handheld computer at a point external to the data bus and the handheld computer,

c. buffering the data contained in the intercepted messages external to the data bus and the handheld computer,

d. processing the buffered data to determine the start and stop of messages received from the data bus,

e. adding message identifiers to the buffered data as the messages are conveyed to the handheld computer to identify the start and stop of each message,

f. providing an electrical power source separate from the first and second power sources,

g. performing steps (b) through (e) utilizing the electrical power source of step (f)

whereby the amount of processing that the handheld computer is required to undertake for data monitoring and extraction from the data bus is reduced without employing the electrical power sources of either the handheld computer or the engine.

63. A method for creating a data pathway as defined by claim 62, further including the step of providing a wireless link in the data pathway to cause the data to flow wirelessly at least over part of the data pathway.

64. A method for creating a data pathway as defined by claim 62, wherein step (d) includes the step of determining the interbyte timing ratio between distinct messages to determine the start and stop of messages conveyed from the data bus.

65. A method for creating a data pathway as defined by claim 62, wherein step (e) includes the step of adding a delimiting header block having a synchronization sequence and a message length to each data message being conveyed to the handheld computer over the data pathway.

66. A method for creating a data pathway as defined by claim 65, wherein step (e) further includes the step of forming a delimiting header block including a three-byte sequence: [112][254][len][J1587Message] where J1587Message is a standard J1587 formatted message.

67. A method for creating a data pathway as defined by claim 62, wherein the signal levels of the data messages appropriate for transmission by the data bus and for processing by said handheld computer are respectively different and wherein the method further includes the step of converting the signal levels of the data messages to the appropriate levels as the data pass over the data pathway between the vehicle bus and the handheld computer.

68. A method for creating a data pathway as defined by claim 62, further including the step of unpacking data messages received from the handheld computer and scheduling the data messages for transmission to the vehicle bus whenever a complete message is present and the bus has been inactive for the required amount of time based on the priority of the message.

69. The vehicle data system defined in claim 1, wherein said operating system software for said handheld computer is a PALM™ operating system 2.0 or higher.

70. The vehicle data system defined in claim 7, wherein the engine bus employs a CAN 2.0B data link.

71. The vehicle data system defined in claim 1, further including application configuration software for creating a customized database of selected vehicle parameters based on a specific vehicle application.